

Claims

- [c1] 1. A system for monitoring combustible gas comprising:
 - a first phase separator having first outlet;
 - a second phase separator having an inlet and at least one outlet having a opening therefrom, said second separator inlet being fluidly connected to said first separator outlet; and,
 - a first combustible gas sensor adjacent said second separator outlet, said first sensor being spaced a predetermined distance from said second separator outlet opening.
- [c2] 2. The system for monitoring combustible gas of claim 1 further comprising an air movement device, said device arranged to move air between said second separator outlet opening and said first sensor.
- [c3] 3. The system for monitoring combustible gas of claim 2 wherein said first sensor includes a sensing surface, said sensor being arranged such that said sensing surface is perpendicular to said second separator outlet opening.
- [c4] 4. The system for monitoring combustible gas of claim 3 wherein said air movement device is arranged to move air in a direction parallel to said sensing surface.
- [c5] 5. The system for monitoring combustible gas of claim 2 further comprising an orifice coupled between said first separator outlet and said second separator inlet, said orifice being sized to reduce the pressure of the gas stream moving between said first and second separators.
- [c6] 6. The system for monitoring combustible gas of claim 5 wherein said orifice has an opening of less than .025 inches.
- [c7] 7. The system for monitoring combustible gas of claim 6 wherein said orifice has an opening of less than .016 inches.
- [c8] 8. The system of claim 2 wherein said second separator outlet opening is separated from said second separator by a conduit.

- [c9] 9. The system of claim 8 further comprising an orifice coupled to said conduit, said orifice being arranged between said second separator and said outlet opening.
- [c10] 10. The system of claim 9 wherein said second phase separator includes a valve, said valve arranged to drain water from said second separator.
- [c11] 11. The system of claim 10 wherein said orifice has an opening of less than .025 inches.
- [c12] 12. The system of claim 2 wherein said second phase separator is a coalescing filter.
- [c13] 13. An electrochemical system comprising:
an electrochemical cell stack having an oxygen outlet;
a first phase separator having an inlet and at least one outlet, said inlet being connected to said cell stack oxygen outlet;
a second phase separator having an inlet and at least one outlet having a opening therefrom, said second separator inlet being fluidly connected to said first separator outlet; and,
a first combustible gas sensor adjacent said second separator outlet, said first sensor being spaced a predetermined distance from said second separator outlet opening.
- [c14] 14. The electrochemical system of claim 13 further comprising an air movement device, said device arranged to move air between said second separator outlet opening and said first sensor.
- [c15] 15. The electrochemical system of claim 14 wherein said first sensor includes a sensing surface, said sensor being arranged such that said sensing surface is perpendicular to said second separator outlet opening.
- [c16] 16. The electrochemical system of claim 15 wherein said air movement device is arranged to move air in a direction parallel to said sensing surface.
- [c17] 17. The electrochemical system of claim 14 further comprising an orifice coupled between said first separator outlet and said second separator inlet, said

orifice reducing the pressure of the gas stream moving between said first and second separators.

- [c18] 18. The electrochemical system of claim 17 wherein said orifice has an opening of less than .025 inches.
- [c19] 19. The electrochemical system of claim 18 wherein said orifice is sized to reduce the gas pressure to atmospheric pressure.
- [c20] 20. The electrochemical system of claim 13 wherein said second separator outlet opening is separated from said second separator by a conduit.
- [c21] 21. The electrochemical system of claim 20 further comprising an orifice coupled to said conduit, said orifice being arranged between said second separator and said outlet opening.
- [c22] 22. The electrochemical system of claim 21 further comprising a valve connected to said second phase separator, said valve arranged to drain water from said second phase separator.
- [c23] 23. The electrochemical system of claim 22 wherein said orifice is sized to reduce the gas pressure to atmospheric pressure.
- [c24] 24. The electrochemical system of claim 15 wherein said second phase separator is a coalescing filter.
- [c25] 25. A system for monitoring combustible gas comprising:
 - a first phase separator having at least one outlet;
 - a housing having an inlet and at least one outlet, said housing inlet being connected to said first separator outlet; and,
 - a first combustible gas sensor mounted to said first housing, said first sensor sensor having a sensing face being positioned generally perpendicular to said first housing inlet.
- [c26] 26. The system for monitoring combustible gas of claim 25 wherein said sensing face is arranged a predetermined distance from said housing inlet.
- [c27] 27. The system for monitoring combustible gas of claim 26 wherein said

housing includes a wall opposite said housing inlet.

- [c28] 28. The system for monitoring combustible gas of claim 27 wherein said first sensor is mounted vertically above said inlet such that any moisture in the housing would drain away from said first sensor.
- [c29] 29. The system for monitoring combustible gas of claim 26 further comprising a second phase separator having an inlet and at least one outlet, said second separator inlet being connected said first separator outlet and said second separator outlet being connected to said housing inlet.
- [c30] 30. The system for monitoring combustible gas of claim 26 further comprising an orifice connected between said first separator outlet and said second separator inlet, said orifice sized to reduce pressure between said first and second separators.
- [c31] 31. The system for monitoring combustible gas of claim 30 wherein said orifice has an opening of less than .016 inches.
- [c32] 32. The system for monitoring combustible gas of claim 26 further comprising an orifice connected between said second separator outlet and said housing, said orifice being sized to reduce the pressure between said second separator and said housing.
- [c33] 33. The system for monitoring combustible gas of claim 32 further comprising a valve connected to said second phase separator, said valve arranged to drain water from said second phase separator.
- [c34] 34. The system for monitoring combustible gas of claim 33 wherein said orifice is sized to reduce the gas pressure to atmospheric pressure.
- [c35] 35. The system for monitoring combustible gas of claim 30 wherein said second phase separator is a coalescing filter.
- [c36] 36. An electrochemical system comprising:
 - an electrochemical cell stack having an oxygen outlet;
 - a first phase separator having an inlet and at least one outlet, said inlet

being connected to said cell stack oxygen outlet;
a housing having an inlet and at least one outlet, said housing inlet being
connected to said first separator outlet; and,
a first combustible gas sensor mounted to said first housing, said first
sensor sensor having a sensing face being positioned generally
perpendicular to said first housing inlet.

- [c37] 37. The electrochemical system of claim 36 wherein said sensing face is
arranged a predetermined distance from said housing inlet.
- [c38] 38. The electrochemical system of claim 37 wherein said housing includes a
wall opposite said housing inlet.
- [c39] 39. The electrochemical system of claim 38 wherein said first sensor is mounted
vertically above said inlet such that any moisture in the housing would drain
away from said first sensor.
- [c40] 40. The electrochemical system of claim 37 further comprising a second phase
separator having an inlet and at least one outlet, said second separator inlet
being connected said first separator outlet and said second separator outlet
being connected to said housing inlet.
- [c41] 41. The electrochemical system of claim 37 further comprising an orifice
connected between said first separator outlet and said second separator inlet,
said orifice sized to reduce pressure between said first and second separators.
- [c42] 42. The electrochemical system of claim 41 wherein said orifice has an opening
of less than .016 inches.
- [c43] 43. The electrochemical system of claim 37 further comprising an orifice
connected between said second separator outlet and said housing, said orifice
being sized to reduce the pressure between said second separator and said
housing.
- [c44] 44. The electrochemical system of claim 43 further comprising a valve
connected to said second separator, said valve arranged to drain water from
said second phase separator.

- [c45] 45. The electrochemical system of claim 44 wherein said orifice is sized to reduce the gas pressure to atmospheric pressure.
- [c46] 46. The electrochemical system of claim 41 wherein said second phase separator is a coalescing filter.
- [c47] 47. A system for monitoring combustible gas comprising:
a gas temperature controller having an inlet and an outlet, said controller reducing the relative humidity of the gas to less than 95% relative humidity; and,
a combustible gas sensor coupled to said controller outlet.
- [c48] 48. The system for monitoring combustible gas of claim 47 wherein said controller is a heater, said heater increasing the temperature of the gas between said inlet and outlet.
- [c49] 49. The system for monitoring combustible gas of claim 47 wherein said controller is a chiller, said chiller decreasing the temperature of the gas between said inlet and outlet.
- [c50] 50. The system for monitoring combustible gas of claim 49 wherein said chiller includes a phase separator having a drain, wherein water in the gas condenses in said phase separator and is removed through said drain.
- [c51] 51 The system for monitoring combustible gas of claim 48 wherein said heater includes heat tape.
- [c52] 52. A method for monitoring the level of combustible gas comprising:
injecting a gas stream into a housing;
impacting said gas stream into a wall;
mixing said gas stream with air; and,
sensing levels of combustible gas in said mixed gas stream.
- [c53] 53. The method for monitoring the level of combustible gas of claim 52 further comprising the step of draining water from said housing.
- [c54] 54. The method for monitoring the level of combustible gas of claim 53 further

comprising the step of flowing said mixed gas stream into a second housing.

- [c55] 55. A method for monitoring the level of combustible gas comprising:
separating water from a gas stream in a first phase separator;
flowing said gas stream through an orifice to restrict flow and decrease
pressure of said gas stream; and,
monitoring the level of combustible gas in said gas stream.
- [c56] 56. The method for monitoring the level of combustible gas of claim 55 further
comprising the step of recycling said separated water.
- [c57] 57. The method for monitoring the level of combustible gas of claim 56 wherein
said recycling step recycles said water into said first phase separator.
- [c58] 58. The method for monitoring the level of combustible gas of claim 55 further
comprising the step of separating water from a saturated gas stream in a
second phase separator.
- [c59] 59. A method for monitoring the level of combustible gas comprising:
separating water from a gas stream;
controlling the temperature of said gas stream to reduce the relative
humidity of said gas stream; and,
monitoring the level of combustible gas in said gas stream.
- [c60] 60. The method for monitoring the level of combustible gas of claim 59 wherein
said controlling of the gas stream temperature includes cooling said gas stream
prior to separation.
- [c61] 61. The method for monitoring the level of combustible gas of claim 59 where
said controlling of the gas stream temperature includes heating said gas stream
prior to monitoring the level of combustible gas in said gas stream.